Notice of Allowability	Application No.	Applicant(s)	
	10/783,295	DOMINGUEZ ET AL.	
	Examiner	Art Unit	
	BERNARD KRASNIC	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *12/17/2007*.

2. ☒ The allowed claim(s) is/are *1, 3-6, 8-10, 12, 14-17, and 19-21 renumbered as 1-16*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20080318* .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

1. This Office Action incorporates an Examiner's Amendment and Reasons For Allowance.

2. The Applicant's response to the last Office Action, filed 12/17/2007 has been entered and made of record.

3. The Applicant has canceled claim(s) 2 and 13.

4. The application has pending claim(s) 1, 3-12, and 14-22.

EXAMINER'S AMENDMENT

5. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Randall Heald (Reg. No. 28,561) on March 18, 2008.

The application has been amended as follows:

For the claims on pages 3-13 of the Applicant's Amendment After Non-Final dated 12/17/2007:

1. Please amend the claims as shown by the attached pages.

CLAIMS

1. (currently amended) A computer-based method for detecting one or more edges in a multiple pixel digital image comprising the steps of:

loading a multiple pixel digital gray scale image to be analyzed from an external source of images into an operating memory of a computer;

analyzing said image for edges with an image edge detection application run by said computer, said application comprising the steps of:

1) selecting a pixel in said image to be analyzed;

2) identifying a plurality of potential edge paths which pass through said selected pixel;

3) calculating an average pixel intensity gradient value for each of said edge paths by comparing a gray level intensity of pixels on one side of each of said edge paths to a gray level intensity of pixels on an opposite side of each of said edge paths;

4) selecting the greatest of said average pixel intensity gradient values of said edge paths as an input to a single fuzzy membership function and generating with said function, a plurality of output values that are related to a degree to which said pixel represents an edge in said image;

5) combining said plurality of output values using a weighted averaging analysis comprising an averaging union of truncated output singletons to assign a crisp edginess value to said pixel;

6) assigning a new edginess based gray level value to said pixel by multiplying an original gray level value of said selected pixel by said crisp edginess value, said new

edginess based gray level value being proportional to an edginess degree of said selected pixel; and

7) repeating steps (1)-(6) for additional pixels in said image.

2. (cancelled)

3. (previously presented) The computer-based method of claim 1, wherein four edge paths are identified that pass through said pixel.

4. (previously presented) The computer-based method of claim 1, wherein said average pixel intensity gradient value for each of said edge paths is calculated by:

selecting an n x n pixel window, where n is an odd number greater than or equal to 3 and said pixel to be analyzed is located at a center of said window;

calculating a first, average pixel intensity value of pixels in said window on a first side of said edge path;

calculating a second, average pixel intensity value of pixels in said window on a second, opposite side of said edge path; and,

calculating a difference between said first and second values to obtain said average pixel intensity gradient value.

5. (currently amended) The computer-based method of claim 1, wherein said step of generating a plurality of output values with said single membership function comprises:

employing an input membership function to generate a plurality of input values relating said average pixel intensity gradient value to a plurality of degrees of intensity;

applying a plurality of inference rules in an output membership function that relate the plurality of intensity degrees to a corresponding plurality of edginess degrees and thereby generate said plurality of output values.

6. (previously presented) The computer-based method of claim 5, wherein three of said input values, three of said inference rules and three of said output values are employed; said input values being small, medium and large; said output values being no edge, mild edge and edge; and said inference rules being if the average pixel intensity gradient value is small, the pixel is not an edge; if the average pixel intensity gradient value is medium, the pixel is a mild edge; and, if the average pixel intensity gradient value is large, the pixel is an edge.

7. (cancelled)

8. (currently amended) A computer-based method for detecting one or more edges in a multiple pixel digital image comprising the steps of:

loading a multiple pixel digital gray scale image to be analyzed from an external source of images into an operating memory of a computer;

analyzing said image for edges with an image edge detection application run by said computer, said application comprising the steps of:

1) selecting a pixel in said image to be analyzed;

2) selecting an n x n pixel window, where n is an odd number greater than or equal to 3 and said window includes a center pixel, wherein said center pixel is said pixel to be analyzed;

3) identifying a plurality of edge paths that run through said center pixel and divide said window into first and second groups of pixels;

4) for each of said edge paths, calculating a first, average pixel intensity value of pixels in said first group and a second, average pixel intensity value of pixels in said second group; and, calculating a difference between said first and second values to obtain an average pixel intensity gradient value for each said edge path;

5) selecting the greatest of said average pixel intensity gradient values as an input to [[an input]] a single fuzzy membership function to generate a plurality of input values relating said average pixel intensity gradient value to a plurality of degrees of intensity;

6) applying a plurality of inference rules in an output membership function that relate the plurality of intensity degrees to a corresponding plurality of edginess degrees

and generate a plurality of output values that are related to a degree to which said center pixel represents an edge in said image;

7) combining said plurality of output values using a weighted averaging analysis comprising an averaging union of truncated output singletons to assign a crisp edginess value to said center pixel;

8) assigning a new edginess based gray level value to said pixel by multiplying an original gray level value of said selected pixel by said crisp edginess value, said new edginess based gray level value being proportional to an edginess degree of said selected pixel; and,

9) repeating steps (1)-(8) for additional pixels in said image.

9. (original) The computer-based method of claim 8, wherein four edge paths are identified that pass through said pixel.

10. (previously presented) The computer-based method of claim 8, wherein three of said input values, three of said inference rules and three of said output values are employed; said input values being small, medium and large; said output values being no edge, mild edge and edge; and said inference rules being if the average pixel intensity gradient value is small, the pixel is not an edge; if the average pixel intensity gradient value is medium, the pixel is a mild edge; and, if the average pixel intensity gradient value is large, the pixel is an edge.

11. (cancelled)

12. (currently amended) A computer system for detecting one or more edges in a multiple pixel digital image comprising:

a processor;

an operating memory interfaced to and readable by said processor;

an external source of multiple pixel digital gray scale images to be analyzed for edges; and

an image edge detection application embodied in said operating memory and executable by said processor for performing process steps for retrieving a multiple pixel gray scale digital image from said external source and detecting edges in said image, said process steps comprising the steps of:

1) retrieving an image to be analyzed from said source of images;

2) selecting a pixel in said image to be analyzed;

3) identifying a plurality of edge paths which pass through said selected pixel;

4) calculating an average pixel intensity gradient value for each of said edge paths by comparing a gray level intensity of pixels on one side of each of said edge paths to a gray level intensity of pixels on an opposite side of each of said edge paths;

5) selecting the greatest of said average pixel intensity gradient values of said edge paths as an input to a single fuzzy membership function and generating with said function, a plurality of output values that are related to a degree to which said pixel represents an edge in said image;

6) combining said plurality of output values using a weighted averaging analysis comprising an averaging union of truncated output singletons to assign a crisp edginess value to said pixel;

7) assigning a new edginess based gray level value to said pixel by multiplying an original gray level value of said selected pixel by said crisp edginess value, said new edginess based gray level value being proportional to an edginess degree of said selected pixel; and,

8) repeating steps (2)-(7) for additional pixels in said image.

13. (cancelled)

14. (previously presented) The computer system of claim 12, wherein said application identifies four edge paths that pass through said pixel.

15. (previously presented) The computer system of claim 12, wherein said application calculates said average pixel intensity gradient value by:

selecting an n x n pixel window, where n is an odd number greater than or equal to 3 and said pixel to be analyzed is located at a center of said window;

calculating a first, average pixel intensity value of pixels in said window on a first side of said edge path;

calculating a second, average pixel intensity value of pixels in said window on a second, opposite side of said edge path; and,

calculating a difference between said first and second values to obtain said average pixel intensity gradient value.

16. (currently amended) The computer system of claim 12, wherein said application carries out said step of generating a plurality of output values with said single membership function by:

employing an input membership function to generate a plurality of input values relating said average pixel intensity gradient value to a plurality of degrees of intensity;

applying a plurality of inference rules in an output membership function that relate the plurality of intensity degrees to a corresponding plurality of edginess degrees and thereby generate said plurality of output values.

17. (previously presented) The computer-based method of claim 16, wherein three of said input values, three of said inference rules and three of said output values are employed; said input values being small, medium and large; said output values being no edge, mild edge and edge; and said inference rules being if the average pixel intensity gradient value is small, the pixel is not an edge; if the average pixel intensity gradient value is medium, the pixel is a mild edge; and, if the average pixel intensity gradient value is large, the pixel is an edge.

18. (cancelled)

19. (currently amended) A computer system for detecting one or more edges in a multiple pixel digital image comprising:

a processor;

an operating memory interfaced to and readable by said processor;

an external source of multiple pixel digital gray scale images to be analyzed for edges; and,

an image edge detection application embodied in said operating memory and executable by said processor for performing process steps for retrieving a multiple pixel gray scale digital image from said external source and detecting edges in said image, said process steps comprising the steps of:

1) retrieving an image to be analyzed from said source of images;

2) selecting a pixel in said image to be analyzed;

3) selecting an n x n pixel window, where n is an odd number greater than or equal to 3 and said window includes a center pixel, wherein said center pixel is said pixel to be analyzed;

4) identifying a plurality of edge paths that run through said center pixel and divide said window into first and second groups of pixels;

5) for each of said edge paths, calculating a first, average pixel intensity value of pixels in said first group and a second, average pixel intensity value of pixels in said second group; and, calculating a difference between said first and second values to obtain an average pixel intensity gradient value for each said edge path;

6) selecting the greatest of said average pixel intensity gradient values as an input to [[an input]] a single fuzzy membership function to generate a plurality of input values relating said average pixel intensity gradient value to a plurality of degrees of intensity;

7) applying a plurality of inference rules in an output membership function that relate the plurality of intensity degrees to a corresponding plurality of edginess degrees and generate a plurality of output values that are related to a degree to which said center pixel represents an edge in said image;

8) combining said plurality of output values using a weighted averaging analysis comprising an averaging union of truncated output singletons to assign a crisp edginess value to said center pixel; [[and,]]

9) assigning a new edginess based gray level value to said pixel by multiplying an original gray level value of said selected pixel by said crisp edginess value, said new edginess based gray level value being proportional to an edginess degree of said selected pixel; and,

10) repeating steps ([[1]] 2)- (9) for additional pixels in said image.

20. (original) The computer system of claim 19, wherein said application identifies four edge paths that pass through said pixel.

21. (previously presented) The computer-based method of claim 19, wherein three of said input values, three of said inference rules and three of said output values are employed; said input values being small, medium and large; said output values being no edge, mild edge and edge; and said inference rules being if the average pixel intensity gradient value is small, the pixel is not an edge; if the average pixel intensity gradient value is medium, the pixel is a mild edge; and, if the average pixel intensity gradient value is large, the pixel is an edge.

22. (cancelled)

REASONS FOR ALLOWANCE

6. The following is an examiner's statement of reasons for allowance:

Independent claims 1, 8, 12, and 19 are allowable over the prior art of record. Claims 3-6 depend from independent claim 1 and therefore are allowed. Claims 9-10 depend from independent claim 8 and therefore are allowed. Claims 14-17 depend from independent claim 12 and therefore are allowed. Claims 20-21 depend from independent claim 19 and therefore are allowed.

Independent claims 1, 8, 12, and 19 each respectively recite the limitation of: combining said plurality of output values using a weighted averaging analysis comprising an averaging union of truncated output singletons to assign a crisp edginess value to said pixel; assigning a new edginess based gray level value to said pixel by multiplying an original gray level value of said selected pixel by said crisp edginess value, said new edginess based gray level value being proportional to an edginess degree of said selected pixel.

The combination of these features as cited in the claims in combination with the other limitations of the claims, are neither disclosed nor suggested by the prior art of record.

The closest reference Khamy ("A fuzzy gradient-adaptive lossy predictive coding technique" – IEEE – March 2003) discloses a system for predicting edges with different orientations using fuzzy prediction schemes as a way to implement fuzzy logic-based lossy predictive coding for gray-scale still image compression. However, Khamy does not teach the limitations cited above.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard Krasnic whose telephone number is (571) 270-1357. The examiner can normally be reached on Mon-Thur 8:00am-4:00pm and every other Friday 8:00am-3:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Bernard Krasnic
March 18, 2008
/Jingge Wu/
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